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RESEARCH FOR BETTER CROP PRODUCTION

An Outline of the Objectives and Functions of the Bureau of Plant Industry, Soils, and Agricultural Engineering, with Recent Examples of Accomplishments

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RESEARCH FOR BETTER CROP PRODUCTION in the United States has resulted in benefits not only for those in agriculture and related fields but also for the general public and the Nation as a whole. Specific examples of these benefits include accomplishments in reducing the costs and increasing the efficiency of farm operations; in making more certain an assurance of ample supplies of food, feeds, and fiber; in improving crop- and soil-management systems for a more readily sustained profitable production without the loss of basic resources; and in promoting the prospects for a future of human welfare and national security. These accomplishments, especially those noted during a period of great emergency, are further significant as indicating the facility with which research can be adapted to varied conditions and itself serve the constant purpose of adapting agriculture to changing circumstances.

COOPERATION CHARACTERIZES RESEARCH PROGRAM

It seems apparent on reflection that this success is due not only to the enterprise of agricultural scientists but also in large measure to the mechanisms for coordinated cooperative research that have been developed in this country and to the facility with which it has been possible to use these mechanisms.

The Bureau of Plant Industry, Soils, and Agricultural Engineering, for example—one of seven agencies whose programs are coordinated in the Agricultural Research Administration—is peculiarly concerned with national problems in administering the work at its central headquarters, at Federal field stations throughout the Nation, and at four regional laboratories. There are many accomplishments to be reported as a year's results in this work, and all but a very few of them are joint accomplishments of the Bureau and some State agricultural experiment station. A major part of the Bureau's work is, in fact, carried on in cooperation with the States at 92 State experiment stations and substations.

Many of the accomplishments are likewise the results of cooperation with private agencies. So few have been the national problems without some major aspects which are also State problems that one of the most important services performed by this Federal agency for the entire Nation has thus been the coordinating help given to State, local, and private research enterprises.

It is not merely that these particular problems have in this way been solved more quickly. It is not merely that the waste in duplicated efforts has been avoided. It is rather that in the long run, considering all the possible benefits and beneficiaries, the farmers throughout the Nation, and the Nation itself, have been best served through cooperation. With the sort of program that has been developed, benefits to different groups are more nearly simultaneous, rather than serial. Growers throughout the country, in other words, can the more quickly apply benefits that might otherwise for years be enjoyed only in limited areas.

An outstanding recent accomplishment in plant breeding, for example, was the development of the means for producing hybrid onions. This is a finding of as great importance to onion growers as the earlier development of hybrid corn was to corn growers—a development that in 1943 added more than 650 million bushels to the national corn harvest. Yet, but for the means of cooperation that are available, it would be years before the benefits of hybrid onions could be enjoyed throughout the Nation.

It was, in fact, the discovery at a California experiment station of a male-sterile onion plant some years ago that suggested the possibility of a feasible hybrid onion seed industry. By 1944 it had been found that the genetic factor which made this plant male sterile could be introduced into other varieties, and intensive research at the Bureau's Plant Industry Station had demonstrated that such male-sterile parents when pollinated by another variety would yield seed capable of producing crops 20 to 50 percent greater than those produced by normal seeds. By introducing male sterility into a variety it had been proved possible to accomplish through genetics the same thing that is done more simply when the tassels of one hybrid corn parent are removed by hand.

Yet by 1944 only one actual hybrid onion variety—California Red Hybrid No. 1—had been released; only in the Southwest could onion growers realize the 20- to 50-percent increases that hybrid onion seed makes possible. Thus it was that in the spring of 1944 the hybrid onion greenhouses at the Plant Industry Station were operated on a 7-day-a-week basis, not for the creation of particular varieties, but for the production of foundation breeding stock that could be distributed to cooperators who simultaneously would develop many hybrid varieties, each adapted to a particular region. In this way, agricultural research gives its most effective service.

COOPERATIVE RESEARCH PREPARED FOR WAR

How great such a service can be is evident in the difference that cereal breeding, for instance, has made in the Nation's situation since World War I—when disease-resistant cereal varieties were almost unknown, when stem rust took an enormous toll of a critical wheat harvest, and when, as a result, the Nation knew wheatless days and wheatless meals. Progress in cereal breeding has now not only removed hazards to an adequate production for domestic needs but also has helped greatly in making it possible for the United States to become the granary as well as the arsenal of democracy. Essential to this progress has been the cooperative nature of the cereal-breeding program, for as a result, the new varieties have included those specifically adapted to various regions. On some 65 million acres used for wheat, to cite one example, new varieties have supplanted or are supplanting the old in nearly all areas, and in each case the new varieties have resulted from cooperative programs. Similar developments have taken place with reference to oats, barley, flax, sorghum, and rice, and the now familiar development of hybrid corn has been one of the most revolutionary agricultural accomplishments of our time.

Also typical of the success with which the Nation's cooperative research facilities have been used in solving problems of producing war crops are the contributions made in connection with peanut production, to cite another specific example—contributions made

not only through cooperation between State and Federal agencies but also through coordinated efforts of agricultural engineers, soil scientists, and crop specialists. Peanuts have been needed in much greater quantities than ever before—as a source of vegetable oil, for peanut butter and other food products, and for forage. As with other particularly war crops, many of which might be similarly discussed, research has been of great value in helping farmers make the needed expansion in production and make it in the wisest way possible. It has been found, for example, that if either Spanish or Runner peanuts are planted at twice the currently practiced rate of seeding the increased yields much more than pay for the extra seed. Three superior strains of the Spanish-type peanut have been developed and tested cooperatively at the Georgia Agricultural Experiment Station—strains that increase yields by 15 to 20 percent and produce 50 to 100 pounds more oil per acre on good land.

What is good land—or the best land—for peanuts is a question that soil scientists have helped answer. During the war these scientists have given special emphasis to the soil requirements of hemp, guayule, and other critical war crops, as well as peanuts and food crops in general. Schematic soil maps have been prepared that show where such crops can be grown most effectively, and interpretive groupings of soil types have been shown on many existing maps. An outstanding example is the contribution to Georgia's cooperative publication on Peanut Production Possibilities in Georgia, and to a similar South Carolina cooperative publication, in which it was possible to include maps showing the excellent, good, fair, and unsuitable areas.

Agricultural engineers likewise have contributed to the solution of peanut-production problems. A harvester, for example, has been built that will dig, shake, and windrow two rows of vines at a speed of 4 miles per hour. This machine, which has been thoroughly tried out, reduces the labor requirement to half a man-hour per acre, whereas 20 to 25 man-hours an acre were required with the one-mule equipment and the hand methods commonly used. A farm-size sheller for hulling seed has also been developed, which is simple, effective, low in cost, and capable of shelling as many peanuts in an hour as a man can shell by hand in 300 hours.

Fertilizer technologists also are involved in a broad program of integrated research; and a recent achievement in fertilizer technology, the development of granular ammonium nitrate, exemplifies still another aspect of cooperative agricultural research—cooperation with industry. In the spring of 1943 surplus nitrogen as ammonium nitrate began to be released from munitions plants, offering a most fortunate solution to the nitrogen shortage except for the fact that ammonium nitrate, in the form available, absorbed so much moisture that its use was not practical. In cooperation with producers and with the fertilizer industry, investigators studied this problem in every conceivable way. As a result, in less than a year a suitable treatment had been devised, and a new product—granular ammonium nitrate with a moisture-resistant coating on each granule—was made available.

FUTURE DEVELOPMENTS FORESEEN

Thus instances of achievement during only 1 year point clearly to the advantages of cooperative research, and the full annual report of the Bureau shows that such instances are numerous in all fields of activity—in cotton and fiber, forage, rubber, sugar, tobacco, and drug

and related crops; in forest pathology; dry-land and irrigation agriculture; mycology and nematology; and plant exploration and introduction, as well as in the fields from which specific examples have been chosen. Just as clearly would a survey of the present needs point to the importance of further progress along the same lines, particularly in the post-war years immediately ahead; for American agriculture, so largely exploitive in the past, can most effectively through research make an efficient and profitable use of soil and other resources on a sustained and permanent basis.

There is not yet an adequate knowledge of all our soils. Adapted crops resistant to diseases are available for only a relatively small part of our crops and crop areas. Very little has yet been accomplished in developing insect-resistant varieties, and they can be developed. Suitable pasture grasses and legumes are still unrealized needs for sound land use programs in large areas of the country. Knowledge of human and animal nutrition in relation to soils and the crops grown on them is still in its infancy. Much can still be done to increase efficiency in handling, storing, and transporting products and in developing labor-saving devices. The mechanisms now available for cooperative research must thus be developed further and used even more effectively than they have been in the past.

OUTLINE OF THE BUREAU'S FUNCTIONS

Conducted with these basic objectives, the work of the Bureau of Plant Industry, Soils, and Agricultural Engineering comprises investigations of soils, fertilizers, plants, farm machines and structures, and methods of growing, harvesting, storing, and doing certain primary processing of crops.

Soils are studied from the standpoint of their distribution, adaptation to use, and management. By means of surveys and maps—combined with experiments in the field, greenhouse, and laboratory—systems of management for efficient crop production and soil improvement are determined. Problems of soil fertility, fertilizers, soil tilth and tillage, drainage and irrigation, salinity, and soil-borne plant diseases are all involved.

Fertilizer investigations include the development of improved materials and more efficient methods of manufacture and use.

Research with plants is concerned with reducing production hazards and improving the quality of crops. One of the principal ways of doing this is by breeding new strains or varieties that are resistant to disease, heat, drought, and cold.¹ Many of these result from plant exploration and introduction from other countries. Other studies are concerned with weed control and methods of planting, harvesting, transportation, and storage of crop plants.

Agricultural engineering research includes the design of new machines or the improvement of old ones; development of new methods of carrying out farm operations, including seedbed preparation, planting, cultivation, harvesting, storing, and primary processing; and the design of farm buildings and equipment.

The Bureau maintains experimental farms, greenhouses, and laboratories at its national headquarters at the Plant Industry Station, Beltsville, Md., and conducts research in cooperation with the State agricultural experiment stations, at various field stations and laboratories throughout the country, and at four regional laboratories—the United States Regional Vegetable Breeding Laboratory, Charleston, S. C.; the United States Regional Pasture Research Laboratory, State College, Pa.; the United States Regional Soybean Laboratory, Urbana, Ill.; and the United States Regional Salinity Laboratory, Riverside, Calif. It also administers the National Arboretum at Washington, D. C.

¹ The 1944 annual report includes 43 new and improved varieties—12 corn hybrids, 4 sorghum, 3 flax, 3 wheat, 2 alfalfa, 2 cabbage, 2 potato, 2 sugarcane, and 1 each of barley, bluegrass, bromegrass, broomcorn, buffalo grass, lespedeza, lettuce, onion, peach, pumpkin, snap bean, soybean, and strawberry.